Begin

#641

CHAYLAKHYAN, M.Kh.; VARSEGYAN, S.G.; NUBARYAN, F.M.; KOCHANKOV, V.G.

Effect of gibberelin on the growth and yield of tobacco in connection with the dates of treatment. Izv. AN Arm. SSR. Biol. nauki 15 no.2:3-11 '62. (MIRA 15:3)

1. Institut zemledeliya Ministerstva sel'skogo khozyaystva Armyanskoy SSR i Institut fiziologii rasteniy imeni K.A. Timiryazeva AN SSSR.

(TOBACCO)
(GIBBERELLINS)

KAMEIC, V.; VARSEK, M.

New methods for early diagnosis of laryngeal diseases. Zdrav. vestn. 34 no.3:56-57 '65.

1. Otorinolaringoloska klinika medicinske fakultete v Ljubljani (predstojnik: Prof. dr. Janko Pompe).

VARSHAL, B.G.

Dependence of the devitrification of window glass on the alumina : magnesia ratio. I. I. Kitaigorodskii, T. N. Keshishyan and B. G. Varshal. (*Glass & Ceramics, Moscow*, 1955, **12**, No. 2, 4).—The low devitrification tendency of Al_2O_3–MgO glasses (normally containing >1% of Al_2O_3) depends not only on the amounts of Al_2O_3 and MgO but also on their ratio. Compositions of seven glasses investigated are tabulated; those with an Al_2O_3 : MgO ratio of 0·33—0·50 have the lowest rate of crystal growth and a fairly narrow temp. interval of crystallization. BRIT. CERAM. RES. ASS. ABSTR. (R.B.C.).

MT

(2)

VARSHAL, B.G.

USSR/ Chemistry - Glass manufacture

Card 1/1 Pub. 104 - 2/11

Authors : Kitaygorodskiy, I. I., Prof. Dr. of Tech. Sc.; Keshishyan, T. N.; and Varshal, B. G.

Title : Crystallization properties of window glass and its dependence upon the value of the alumo-magnesia coefficient

Periodical : Stek. i ker. 2, 4 - 5, Feb 1955

Abstract : Experiments were conducted to determine the change in the crystallization characteristics of window glass due to the change in the chemical composition of alumo-magnesia glass. The results obtained are given in tables and graph. A comparison of the results showed that glass with an alumo-magnesia coefficient of $K_{\frac{A}{M}} = 0.330 - 0.500$ possesses the minimum rate of crystallization and a very narrow temperatureinterval of crystallization. Two USSR references (1939 - 1952). Tables; graph.

Institution: .....

Submitted: .....

VARSHAL, B.G.

USSR /Chemical Technology. Chemical Products and Their Application I-12

Silicates. Glass. Ceramics. Binders.

Abs Jour: Referat Zhur - Khimiya, No 9, 1957, 31475

Author : Keshishyan T.N., Varshal B.G.

Title : Synthesis of Devitrite

Orig Pub: Sb. nauch. rabot po khimii i tekhnol. silikatov. M., Promstroyizdat 1956, 339-343

Abstract: The paper describes the synthesis, petrographic, thermographic, roentgenographic and electronographic studies of devitrite -- $Na_2O.3CaO.6SiO_2$ (I). A glass having the composition of I was obtained and a study of its crystallization properties was carried out. Maximum rate of growth of crystals of I is of 115 μ/minute at 960° . I was

Card 1/2

USSR /Chemical Technology. Chemical Products and Their Application I-12

Silicates. Glass. Ceramics. Binders.

Abs Jour: Referat Zhur - Khimiya, No 9, 1957, 31475

obtained by crystallization of the glass at 900-920°. Roentgenographic investigation of I yielded 46 interplanar distances of the lattice. Also given are the relative intensities of the lines. To check the results an electronographic study was used. An alcoholic suspension of I, and a suspension of I in a 0.5% solution of celluloid in amyl acetate, were utilized. In this manner lines were determined which correspond to 10 interplanar distances of I. Bibliography 7 references.

Card 2/2

KESHISHYAN, T.N.; VARSHAL, B.G.; FAYNBERG, Ye.A.

Changes in the crystallization properties of aluminum - magnesium glass as dependent on the $CaO:MgO:Al_2O_3$ ratio. Trudy MKHTI no.24: 237-246 '57. (MIRA 11:6)

(Glass research) (Vitreous state)

BUTT, Yu.M., doktor tekhn.nauk, prof.; MAYYER, A.A., kand.tekhn.nauk; VARSHAL, B.G., inzh.

Interaction between lime and cinder during pressure autoclaving. Sbor. trud. ROSNIIMS no.17:55-65 '60. (MIRA 14:12)
(Hydration) (Autoclaves)
(Binding materials)

VARSHAL, B. G. Cand Tech Sci -- "Study of ~~the~~ process of hardening ~~process of~~ lime ~~and~~ ash binders ~~cements~~." Mos, 1961 (Min of Higher and Secondary Specialized Education RSFSR. Mos Order of Lenin Chemicotechnological Inst im D. I. Mendeleyev). (KL, 4-61, 195)

APPROVED FOR RELEASE: 08/31/2001 CIA-RDP86-00513R001858710001-0"

BUTT, Yu.M.; VARSHAL, B.G.; MAYYER, A.A.

Resistance of hydrogarnets to carbonization. Zhur.VKHO 6 no.3: 355-356 '61. (MIRA 14:6)

1. Moskovskiy khimiko-tekhnologicheskiy institut imeni D.I. Mendeleyeva.

(Garnets)

BUTT, Yu.M., doktor tekhn.nauk, prof.; VARSHAL, B.G., inzh.; MAYYER, A.A., kand.tekhn.nauk

Hydration of shale cinders from Syzran deopsits. Stroi.mat.7 no.2:33-34 F '61. (MIRA 14:3)

(Cinder blocks)

BUTT, Yu.M., doktor tekhn.nauk; VARSHAL, B.G., kand.tekhn.nauk; MAYYER, A.A., kand.tekhn.nauk

The problem of the resistance to air of lime-ash binding materials. Sbor. trud. ROSNIIMS no.20:3-17 '61. (MIRA 16:1)
(Lime) (Ash (Technology)) (Binding materials)

BUTT, Yu.M.; MAYYER, A.A.; VARSHAL, B.G.

Stability of calcium aluminate sulfate hydrates. Dokl. AN SSSR 136 no.2:398-400 '61. (MIRA 14:1)

1. Respublikanskiy nauchno-issledovatel'skiy institut mestnykh stroitel'nykh materialov. Predstavleno akademikom S.I. Vol'fkovichem.
(Calcium aluminate sulfate)

MANUYLOVA, N.S., kand. khim. nauk; VARSHAL, B.G., kand. tekhn. nauk;
MAYYER, A.A., kand. tekhn. nauk

Investigation of the texture and some physico-chemical properties of perlite. Sbor. trud. ROSNIIMS no.25:32-45 '62 (MIRA 17:8)

ACCESSION NR: AR4036317 S/0081/64/000/004/B092/B093

SOURCE: Referativnyy zhurnal. Khimiya, Abs. 4B671

AUTHOR: Mayer, A. A.; Varshal, B. G.; Manuylova, N. S.; Varlamov, V. P.

TITLE: Dehydration of certain zeolites in a vacuum and their rehydration under hydrothermal conditions

CITED SOURCE: Sb. tr. Resp. n.-i. in-t mestn. stroit, materialov, no. 27, 1963, 3-23

TOPIC TAGS: zeolite, dehydration, rehydration, natrolite, analcine, desmin

TRANSLATION: Baking of natural natrolite (Nt) in a vacuum at 200C does not change its properties, but at 400C complete dehydration occurs. Previously dehydrated Nt treated with steam at 20-250 C changes into p-natrolite(PNt). PNt has the same chemical composition and crystalline form as the native Nt, but differs in that the water in it is primarily absorbed water and not water of crystallization as in the natural form. Therefore, PNt has twice the dielectric permeability. Saturation with water vapor at 20-250C does not change the properties of natural Nt and

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ACCESSION NR: AR4036317

PNt. During treatment of vapor saturated PNt at 300C, it changes completely into analcime and sodium hydroaluminate. Natural Nt under the same conditions changes only slightly. Apparently, the presence of water of crystallization makes the substance resistant to the effects of strongly heated steam. Therefore, one should look into this phenomenon as a reason for the complete stability of analcime in an atmosphere of steam at 300C. In other words, the resistance of the mineral to the effects of strongly heated steam is determined by the physical type of water present in it. The presence of water of crystallization in the lattice of Nt provides its crystals with mechanical resistance. After baking in a vacuum at 200C, desmin (Dm) fully retains the ability to be rehydrated. Due to its tridimensional structure, the crystal lattice of Nt does not change during dehydration in a vacuum, which permits the water during rehydration to return in the same quantity. On the other hand, the two dimensional stratified lattice of Dm is destroyed during heating in a vacuum at 400C, and because of that Dm loses the ability to be rehydrated to a considerable extent. During rehydration of dehydrated

ACCESSION NR: AR4036317

Nt and Dm, the water which returns is mainly adsorptive in character. Experiments have shown that in acidic volcanic, water-containing glass, the water is also adsorptive in character. This permits us to make an analogy between perlites and zeolites, many of which similarly swell up when heated. Authors' summary.

DATE ACQ: 10Apr64 SUB CODE: IC ENCL: 00

Card 3/3

ACCESSION NR: AP4035100 S/0191/64/000/005/0015/0019

AUTHOR: Popov, V. A.; Druyan, I. S.; Varshal, B. G.

TITLE: Investigation of the processes occuring during heating polymers by the method of thermal analysis of phenol-aldehyde resin.

SOURCE: Plasticheskiye massy*, no. 5, 1964, 15-19

TOPIC TAGS: thermal analysis, thermogram, weight loss curve, thermal effect, polymer, thermal oxidation, thermooxidative destruction, phenol formaldehyde resin, Novolac 113, Bakelite, Resol 300, Resol 214, Resol 211, Resol 236, linear polymer, combustion, aniline phenol formaldehyde resin

ABSTRACT: The thermo-oxidative destruction of phenol-formaldehyde resins (novolac 113, pulverized Bakelite, resol 300, resol 214, resol 211, resol 236) was investigated. Thermograms and weight loss curves were drawn and a detailed discussion is given of the thermal effects observed. A linear polymer, such as novolac without a hardener, burns completely, but with hexamethylenediamine the weight loss is slower and combustion is not complete. Resol 300 has weight losses similar to hardened novolac, but combustion is slower. The presence of analine or rosin

ACCESSION NR: AP4035100

somewhat lowers the yield of coke and the temperature of the start of large weight loss. Orig. art. has: 3 figures and 1 table.

ASSOCIATION: None

SUBMITTED: 00 ENCL: 00

SUB CODE: MT NO REF SOV: 010 OTHER: 006

Card 2/2

ACCESSION NR: AP4039950 S/0191/64/000/006/0052/0053

AUTHOR: Popov, V. A.; Druyan, I. S.; Varshal, B. G.

TITLE: Investigation by thermal analysis of the processes occurring during heating of polymers.

SOURCE: Plasticheskiye massy*, no. 6, 1964, 52-53

TOPIC TAGS: thermal analysis, polymer thermal degradation, polymer degradation process, SKN 40 rubber, nitrile rubber, nitrile rubber sulfur composition, nitrile rubber novolac composition, thermogram, viscoelastic state, fluid flow, thermal oxidation, combustion

ABSTRACT: SKN-40 rubber, alone or milled with 3% sulfur, and a composition comprising 40 parts by weight of the nitrile rubber plus 100 parts of novolac resin were subjected to thermal analysis. A comparison of the thermograms for SKN-40 heated at 20 and at 100C/min. showed the characteristics were essentially the same, but the features were much sharper at the slower heating rate. An initial endothermic effect at 60-220C is attributed to the increase in the mobility of the rubber and transition from viscoelastic to fluid state. Rearrangement of the

ACCESSION NR: AP4039950

internal structure of rubber occurs at the exotherm above 250C with practically no weight loss. Intense thermal oxidation of rubber and weight loss starts at 360C, with heat being absorbed from 360-455C and combustion then taking place to 565C. Thermograms of the rubber-sulfur and the rubber-novolac compositions were obtained by heating at 20 deg./min. (fig. 1). Addition of sulfur changes the behavior of rubber little; the initial endothermic effect is almost absent and the thermal effects are shifted 30-40 degrees toward the lower temperatures. In the rubber-novolac thermogram the first two endotherms are attributed to successive removal of volatiles and transitions to the fluid state. The first exotherm at 315C is accompanied by practically no loss in weight (as in the other two compositions). Thermooxidative destruction occurs at 445-460C and combustion at 480, with the combustion proceeding at a slower rate than the thermal oxidation. Combustion is completed at 700C with the formation of a small amount of coke. Orig. art. has: 2 figures.

ASSOCIATION: None

SUBMITTED: 00 ENCL: 01

Card 2/4

ACCESSION NR: AP4039950

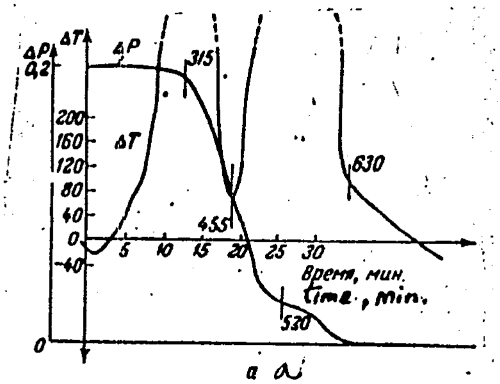
SUB CODE: MT, OC

NO REF SOV: 003

OTHER: 001

Card 3/4

ACCESSION NR: AP4039950 ENCLOSURE: 01



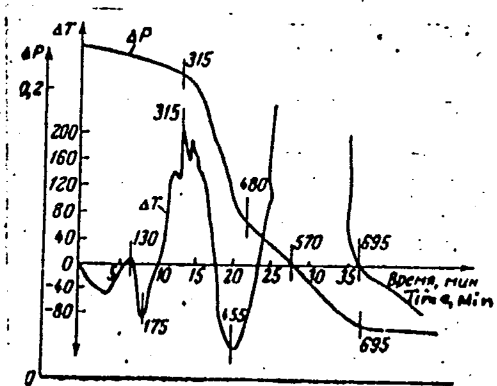


Fig. 1. Thermogram of SKN-40 rubber, mixed on mill with sulfur or phenolformaldehyde resin of the novolac type: a--SKN-40 rubber + 3% sulfur; b--SKN-40 rubber + novolac resin No. 113 (100 wt. parts resin to 40 of rubber).

Card 4/4

MAYYER, A.A.; MANUILOVA, N.S.; VARSHAL, B.G.

Transformation of natrolite under hydrothermal conditions. Dokl. AN SSSR 154 no.2:363-365 Ja'64. (MIRA 17:2)

1. Predstavleno akademikom N.V. Belovym.

VARSHAL, G.M.; SENYAVIN, M.M.

Preparation of nonaqueous solutions of thiocyanic acid by the ion exchange method. Zhur.anal.khim. 17 no.7:903-904 O '62. (MIRA 15:12)

1. Institute of Geology of Ore Deposits, Petrology, Mineralogy and Geochemistry, Academy of Sciences, U.S.S.R., Moscow.
(Thiocyanic acid) (Ion exchange)

AFANAS'YEV, G.D.; PLOSHKO, V.V.; VARSHAL, G.M.

Find of epidote containing dtrontium and rare earths in the Northern Caucasus. Dokl. AN SSSR 143 no.3:682-685 Mr '62. (MIRA 15:3)

1. Institut geologii rudnykh mestorozhdeniy, petrografii, mineralogii i geokhimii AN SSSR. 2. Chlen-korrespondent AN SSSR (for Afanas'yev).
(Urushten Valley--Epidote) (Strontium) (Rare earths)

L 31328-65 EWT(m)/EWP(j)/T Pc-4 RM

ACCESSION NR: AP4047634

AUTHOR: Varshal, G. M.; Senyavin, M. M.

TITLE: The process of paper partition chromatography of

SOURCE: Zhurnal strukturnoy khimii, v. 5, no. 5, 1964, 681-690

TOPIC TAGS: paper partition chromatography rare earth element

ABSTRACT: Among parameters

ACCESSION NR: AP4047634

of the salting out agent cation in the extraction of the rare earth element nitrate thiocyanate and nitrate-trichloroacetate complex ions from aqueous solutions ... the salting out agents ...

experimental data on the partition ...

... configuration of complex rare earth element solvates under the ... the salting out agent cation. It was proposed that chromatographic results may be useful in studying the action of ... the proximate hydration of salted out ions ...

... salting out theory. Orig. art. has: 2 tables and 11 figures

ACCESSION NR: AP4047634

2.

eralogy and Geochemistry AN SSSR) Institut geokhim. i i analiticheskoy khimii AN SSSR (Institute of Geochemistry and Analytical Chemistry AN SSSR)

SUBMITTED: 30Mar64

Card 2/2

VARSHAL, G.M.; RYABCHIKOV, D.I.

Gravimetric determination of the total of rare-earth elements in rocks, minerals, and alloys. Zhur. anal. khim. 19 no.2: 202-207 '64. (MIRA 17:9)

1. Institut geologii rudnykh mestorozhdeniy, petrografii, mineralogii i geokhimii AN SSSR i Institut geokhimii i analiticheskoy khimii imeni V.I. Vernadskogo AN SSSR, Moskva.

L 14520-65 EWT(m)/EWP(j)/EWP(b)/EWP(t) IJP(c)/SSD JD/JG/RM
ACCESSION NR: AP5001425 S/0075/64/019/008/0947/0954

AUTHOR: Varshal, G. M.; Senyavin, M. M.

TITLE: Selection of complex-forming substances in the chromatographic separation of the rare earth elements on paper. Use of trichloroacetic acid

SOURCE: Zhurnal analiticheskoy khimii, v. 19, No. 8, 1964, 947-954

TOPIC TAGS: chromatographic analysis, chemical separation, rare earth metal, methyl ethyl ketone

Abstract: The extraction of rare earth elements with methyl ethyl ketone and solution of HSCN in methyl ethyl ketone from aqueous solutions of ammonium, lithium, sodium, potassium, and rubidium nitrates was investigated, and the results were compared with data on the separation of a mixture of the rare earth elements on paper treated with solutions of the corresponding alkali nitrates. Solutions of thiocyanic acid in organic solvents were used as the mobile solvent; the stationary phase was a saturated aqueous solution of ammonium nitrate adsorbed on the paper. The solvent, solution of HSCN in methyl ethyl ketone, provided a distinct separation of La, Ce,

Card 1/3

L 14520-65

ACCESSION NR: AP5001425

Pr, Nd, Sm, Gd, Y, Dy, Ho, Er, Tm, Yb, and Lu; terbium was not separated from yttrium; in the presence of a large relative content of elements of the cerium group (above 70-80%), the separation of praseodymium from cerium and neodymium was hindered. Basic requirements were formulated for the complex-forming substance in the chromatographic separation of a mixture of the rare earth elements, present together with the NO_3 ion in the internal coordination sphere of the rare earth ion: 1) weak complex formation of the rare earth ions, not leading to displacement of the nitrate ions from the internal coordination sphere; 2) sufficient hydrophobic character of the addend, leading to an increase in the partition coefficients of the rare earth elements in comparison with the nitrate system. The impossibility of using polybasic carboxylic acids and hydroxy acids for the chromatographic separation in the nitrate system was due to their high hydrophilic properties and the great strength of their complexes with the rare earth elements. Monobasic carboxylic acids (especially halo-derivatives with increasing hydrophobic properties) were found to be promising for paper chromatographic separation of mixtures of the rare earth elements. Trichloroacetic acid enabled quantitative separation of elements of the cerium group: La, Ce, Pr, Nd, Sm, and Tb. Yttrium gave a joint zone with dysprosium, holmium with erbium, and thulium with ytterbium and lutecium. Orig. art. has: 4 figures, 1 graph, and 3 tables.

Card 2/3

L 14520-65
ACCESSION NR: AP5001425 2

ASSOCIATION: Institut geologii rudnykh mestorozhdeniy, petrografii, mineralogii i geokhimii AN SSSR (Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry, AN SSSR); Institut geokhimii i analiticheskoy khimii im. V. I. Vernadskogo AN SSSR, Moscow (Institute of Geochemistry and Analytical Chemistry, AN SSSR)

SUBMITTED: 24Sep63 ENCL: 00 SUB CODE: GC, IC

NO REF SOV: 007 OTHER: 007 JPRS

Card 3/3

APPROVED FOR RELEASE: 08/31/2001 CIA-RDP86-00513R001858710001-0"

L 51965-65 EWT(m)/EPF(n)-2/EWP(t)/EWP(b)/EWA(h) Peb/Pu-4 IJP(c)/DIAAP

ACCESSION NR: AT5012687 JD/JG UR/2513/65/015/000/0358/0367 31

AUTHOR: Varshal, G.M.; Bogdanova, V.I.; Senyavin, M.M. Saunkin, O.F. 30 B+1

TITLE: Partition paper chromatography and its application to the relative concentration of elements

SOURCE: AN SSSR. Komissiya po analiticheskoy khimii. Trudy, v. 15, 1965. Metody kontsentrirovaniya veshchestv v analiticheskoy khimii (Methods of concentrating substances in analytical chemistry), 355-367

TOPIC TAGS: paper chromatography, partition chromatography, trace element concentration, rare earth element, niobium analysis, tantalum analysis, cellulose column, neutron bombardment, activation analysis, gamma spectrometry 19

ABSTRACT: The article presents a brief general review of the basic principles of partition paper chromatography, and considers the characteristics of the method and its potential uses in the relative concentration of elements followed by their analytical determination. The separation of a mixture of rare earth elements, niobium, and tantalum was used as an example. Optimum conditions for this separation prevail in nitrate-thiocyanate and trichloroacetatenitrate systems, which were used in the experiments. To show the possibility of increasing the sensitivity of the partition chromatographic

L 51965-65

ACCESSION NR: AT5012687

method, an activation determination of rare earth impurities was carried out in yttrium oxide in the zones of the impurity elements on paper; these zones were cut out and irradiated with neutrons, after which the gamma spectra of the preparations were recorded. It was found that by thus combining activation analysis with partition paper chromatogrphy, one can raise the sensitivity to 10^{-3}-10^{-4}%. The experimental and literature data show that the following two directions are promising: (1) determination of microimpurities by combining paper partition chromatography with such highly sensitive methods as radioactivation, mass spectrometry, luminescence, polarography, and (2) chromatographic separation of many-component systems on cellulose columns for the purpose of separating appreciable amounts of pure substances. Orig. art. has: 3 tables and 1 formula.

ASSOCIATION: Komissiya po analiticheskoy khimii, AN SSSR (Commission on Analytical Chemistry, AN SSSR)

SUBMITTED: 00 ENCL: 00 SUB CODE: IC, NP

NO REF SOV: 014 OTHER: 016

Card 2/2

LISITSINA, G.A.; BOGDANOVA, V.I.; VARSHAL, G.M.; SIROTININA, N.A.

Some geochemical characteristics of the formation of accessory minerals in the granites of the Charkasar Massif in the Kurama Range of the Tien Shan. Geokhimiia no.5:602-616 My '65. (MIRA 18:9)

1. Institut geologii rudnykh mestorozhdeniy, petrografii, mineralogii i geokhimii AN SSSR, Moskva.

VARSHAL, G.M.; BOGDANOVA, V.I.; SENYAVIN, M.M.; SAUNKIN, O.F.

Partition paper chromatography and its use for a relative concentration of elements. Trudy Kom. anal. khim. 15:358-367 '65. (MIRA 18:7)

VARSHALOVICH, A.A.; CHUKSANOVA, N.A.; YAKOVLEVA, N.S.

Early diagnosis of virus diseases of potatoes by means of light analysis. Vest.Len.un. 9 no.1:49-56 Ja '54. (MLRA 9:7)
(Potatoes--Diseases and pests) (Virus diseases of plants)

VARSHALOVICH, Aleksandr Aleksandrovich; SHUTOVA, N.N., spets.red.; RYAUZOVA, N.F., red.; PECHENKIN, I.V., tekhn.red.

[Manual for roentgenographic entomological examination of quarantinable seeds] Rukovodstvo po karantinnoi entomologicheskoi ekspertize semian metodom rentgenografii. Moskva, Izd-vo M-va sel'khoz.SSSR, 1958. 92 p. (MIRA 13:4)

(Seeds--Inspection)

(X rays--Industrial applications)

VARSHALOVICH, A.A., agronom-entomolog

Roentgenographic method of detecting pest infestation in seeds.
Zashch. rast. ot vred. i bol. 3 no.4:42-43 Jl-Ag '58. (MIRA 11:9)
(Seeds--Diseases and pests)

YAKOVLEVA, N.S.; VARSHALOVICH, A.A.

Fluerescence analysis in quarantine examination. Zashch. rast. ot vred. i bol. 6 no.10:50 0 '61. (MIRA 16:6)

1. Leningradskaya laboratoriya po karantinu rasteniy.
(Seed adulteration and inspection)

VARSHALOVICH, A.A.

Dangerous foreign pest of stored produce. Zashch. rast. ot vred. i bol. 8 no.8:50 Ag '63. (MIRA 16:10)

1. Starshiy entomolog Leningradskoy karantinnoy laboratorii.

AUTHORS: Risilov, L. I., Varshalovich, D. A. SOV/89-5-4-5/24

TITLE: Electromagnetic Transitions in Isomeric Nuclei (Elektromagnitnyye perekhody v izomernykh yadrakh)

PERIODICAL: Atomnaya energiya, 1958, Vol 5, Nr 4, pp 432-445 (USSR)

ABSTRACT: A comparison of experimental data with theoretical conceptions is carried out on the strength of available data on transitions in isomeric nuclei. Experimental data on electromagnetic radiation and the quantum-like characteristic of isomeric nuclei agree well with modern conceptions on the structure of atomic nuclei.

The following problems were dealt with and explained:

1) Decay of the metastable nuclear states.
2) Radiation transitions in spherical nuclei.
   a) Permitted transitions in spherical nuclei.
   b) j-forbidden transitions.
   c) l-forbidden transitions.
3) Radiation transitions in deformed nuclei.
   a) Transitions between the levels of a rotation band.
   b) Monoparticle transitions in deformed nuclei.
   c) K-forbidden transitions.

Electromagnetic Transitions in Isomeric Nuclei SOV/89-5-4-5/24

4) 0 - 0 - transitions.
There are 14 figures, 2 tables, and 37 references, 12 of which are Soviet.

SUBMITTED: April 10, 1958

Card 2/2

VARSHALOVICH, D.

Eighth annual convention on atomic spectroscopy. Usp. fiz. nauk. 6 no.4:721-726 Ag '58. (MIRA 11:10)
(Spectrum, Atomic)

AUTHOR: Varshalovich, D. SOV/53-65-4-7/13

TITLE: The VIII Annual Congress of Nuclear Spectroscopy (VIII yezhegodnoye soveshchaniye po yadernoy spektroskopii). I

PERIODICAL: Uspekhi fizicheskikh nauk, 1958, Vol 65, Nr 4, pp. 721 - 722 (USSR)

ABSTRACT: The 8th Congress of Nuclear Spectroscopy took place in Leningrad from January 27 to February 3, 1958. It was attended by 300 scientists from the USSR, further by scientists from China, France, Poland, Czechoslovakia, Hungary, Eastern Germany, Yugoslavia, and the Mongol Democratic Republic. 4 main lectures and about 90 reports were heard. The main lectures dealt with problems concerning nuclear models, the α- and β-decay, γ-radiation, internal conversion, and nuclear isomerism. B.S.Dzhelepov, Corresponding Member, Academy of Sciences, USSR, opened the conference. Lectures were held by: V.Yu. Gonchar, Ye. V. Inopin, S.P.Tsytko (FTI,AS UkrSSR) on light nuclei and generalized nuclei models;L.K. Peker (BAN SSSR-Library AS USSR); Yu.M.Shirokov (MGU-Moscow State University), L.A.Sliv (LFTI-Leningrad Physical-Technical Institute) et al. on levels in Mg^{24},Mg^{25} and Al^{25}; D.G.

Card 1/4

The VIII.Annual Congress of Nuclear Spectroscopy. I SOV/53-65-4-7/13

Alkhazov, A.P.Grinberg, G.M.Gusinskiy, K.I.Yerokhina and I.Kh.Lemberg (LFTI) on having found no rotational levels at E<1 MeV in Cr, In, and Mn nuclei. The same research workers also reported on the discovery of vibrational γ-levels in W^{182}, W^{184}, W^{186}- nuclei by means of the method of the Coulomb (Kulon) excitation at $E_{exc} \sim 1$ MeV. L.K.Peker (BAN SSSR) gave a survey report: "Concerning Some Particulars in Vibrational Levels of Deformed Nuclei". Lectures were held also by: D.F.Zaretskiy (AN SSSR - AS USSR) on radiation transitions in deformed nuclei with the spin = 1/2; V.S. Shpinel' 2 NIFI MGU (2nd Scientific Research Institute of Physics, Moscow State University) on the level displacement and the probability of corresponding β - and γ - transitions in odd nuclei; D.F.Zaretskiy (AN SSSR - AS USSR) on the influence of the spin-orbital coupling upon the magnetic moments of the nuclei, A.I.Baz' (AN SSSR -AS USSR) on the existence of light nuclei with high neutron or proton excess; V.A.Kravtsov (LPI-Leningrad Polytechnic Institute) on the formation of nucleon pairs in nuclei; L.L. Gol'din, A. D. Piliye, G.N.Novikova, K.A.Ter-Martirosyan (TTL AN SSSR)

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on alpha decay on rotational levels of odd nuclei; V.G. Nosov (AN SSSR - AS USSR) on alpha decay of nonspherical nuclei (survey); A.I.Alikhanov, G.P.Yeliseyev, V.A.Lyubimov, V.V.Ershler (TTL AN SSSR) on polarisation measurements at electrons emitted in the β-decay of Tm^{170}, Lu^{177}, Ag^{198}, Sm^{153}, Re^{186} ($\Delta I = 0,1, \Delta\pi = -1$) as well as in that of Sr^{90} and Y^{90} ($\Delta I = 2, \Delta\pi = -1$); V.P.Rudakov (AN SSSR - AS USSR) on measurements of the (β-γ) angular correlations in Ba^{139}-decay; N.A.Burgov and Yu.V.Terekhov (TTL AN SSSR) on investigations of the electron-neutron correlations and the resonance scattering of γ-radiation; B.K.Kerimov and I.M.Nadzhafov (MGU-Moscow State University) on the tremsstrahlung of longitudinally polarized electrons; A.I.Mukhtarov and Yu.S. Perov (MGU) on the effective cross section of the scattering of polarized electrons and positrons at polarized electrons; Ya.E.Chudars and I.Ya.Taurs (Riga) on the determination of the intensity of the components of the complex β-spectrum according to the Fermi diagram; I.M.Band, L.H.Zyryanova, and Yu.P.Suslov, LGU (Leningrad State University) on the computation of the probability of the permitted and of the

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forbidden capture of electrons by a nucleus.

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AUTHOR: Varshalovich, D. SOV/53-65-4-8/13

TITLE: VIII Annual Congress of Nuclear Spectroscopy (VIII.yezhegod-noye soveshchaniye po yadernoy spektroskopii).II

PERIODICAL: Uspekhi fizicheskikh nauk, 1958, Vol 65, Nr 4, pp. 722 - 724 (USSR)

ABSTRACT: Continuation of the list of lectures held at the 8th Congress of Nuclear Spectroscopy, Leningrad, January 27 to February 3, 1958. L.I.Rusinov and D.A.Varshalovich (LFTI) gave a survey report entitled: "Isomerism in Atomic Nuclei". Lectures were also held by: E.Ye.Berlovich (LFTI) on the life times of the first excited states of 2+even-odd nuclei for N = 110 - 116 (transmutation $Os^{190} \longrightarrow Os^{192}$); N.N.Delyagin and V.S. Shpinel' (2 NIFI MGU - 2nd Scientific Research Institute of Physics, Moscow State University) on the measurement of the life time of the first excited state of Mg^{24} (1,37 MeV) by the method of resonance scattering. Result: $\tau_{\gamma} = (1,7 \pm 0,4).10^{-12}$ sec; L.K.Peker, BAN SSSR (Library AS USSR) on particulars of nuclei with low parameters of deformation (β-decay and K-capture of Eu^{152}, level scheme

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of Os^{190} (β=0,15)); M.A.Listengarten LGU (Leningrad State University) on internal conversion (a survey of the experimental and theoretical determination of the coefficient of conversion); V.A.Krutov and K.Myuller (LGU) on the conversion theory in higher approximation; A.G.Sergeyev, V.A. Vorob'yev, A.S.Remenny, G.I.Kol'chinskaya, G.D.Latyshev and Yu.S.Yegorov (LIIZhT-Leningrad Railroad Engineers Institute) on the experimental verification of heoretically found values of the coefficients of the internal conversion; the results agree with those ones obtained by L.A.Sliv, I.M. Band, but differ from the values by M.Rouz; A.V.Gnedich, L.N.Kryukova, V.V.Murav'yeva. V.S.Shpinel' and I.V.Shumshurov (2 NIFI MGU) on the influence of the Doppler effect on the contour and half-width of the lines of conversion electrons emitted by recoil nuclei; S.S.Vasil'yev and L. Ya. Shaftvalov (2 NIFI MGU) on results of investigations of β-spectra and determinations of the half-life of the short-lived isotopes F^{17}, F^{20}, and Al^{28}; L.V.Gustova, B.S. Dzhelepov, P.F.Yermolov and O.V.Chubinskiy (LGU) on the hard γ-radiation of Na^{24} investigated by means of a γ-hodoscope; A.K.Val'ter, I.Ya.Malakhov, P.V Sorokin and A.Ya.

VIII Annual Congress of Nuclear Spectroscopy. II SOV/53-65-4-8/13

Taranov, FTI AN USSR (Physical-Technical Institute, AS UkrSSR) on elastic scattering of protons at Si^{28} nuclei; Ye.P. Grigor'yev, B.S.Dzhelepov, A.V.Zolotavin, V.Ya.Mishin, V.P. Prikhodtseva, Yu.V.Khol'nov and G.Ye.Shchukin (LGU,RIAN) on the decay of As^{74} (investigations by β-spectrometer, $-\beta^+, \beta^-$- and rytron, -γ); Ye.P.Grigor'yev. A.V.Zolotavin (LGU) on the γ-spectrum of Se^{75}; a new line with 206 keV was discovered; G.M.Chernov and I.V.Estulin (2 NIFI MGU) on measurements of the angular correlations of the γ-radiation of Mo^{99}; Yu.A.Aleksandrov and S.V.Golenetskiy (LGU) on the decay scheme of Cs^{134} and the discovery of new γ-lines; L.F.Kalinkin, A.S. Melioranskiy and I.V.Estulin (2 NIFI MGU) on results obtained in the investigation of the weak range of the γ-spectrum on occasion of $Cs^{133}(n\gamma)$ Cs^{134}, $Ag^{107}(n\gamma)$ Ag^{108}, $Te^{123}(n\gamma)Te^{124}$; V.P.Prikhodtseva and Yu.V.Khol'nov (RIAN) on the γ-spectrum of La^{140}; A.A.Bashilov, B.S.Dzhelepov, N.D.Novosil'tseva and L.S.Chervinskaya (LGU) on the conversion spectrum of La^{140} by means of the ketron; Ye.A.Khol'nova (VNIIM) on the determination of the number of γ-quanta, forming in the decay process of La^{140}, by means of the β- and γ-calorimeter;

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VIII Annual Congress of Nuclear Spectroscopy. II SOV/53-65-4-8/13

M.P.Glazunov and B.F.Gulev (1 FKhAN - Institute of Physical Chemistry AS) on β- and γ-spectra of Eu^{155}, Eu^{152}, and Eu^{154}.

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S/048/60/024/03/18/019
B006/B014

24.6510

AUTHORS: Peker, L. K., Varshalovich, D. A.

TITLE: Magnetic Moments of Deformed Nuclei With K = 1/2

19 19

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 3, pp. 372-376

TEXT: The article under review was read at the Tenth All-Union Conference of Nuclear Spectroscopy (Moscow, January 19 - 27, 1960). Deformed nuclei in the state K = 1/2 exhibit a number of peculiar features. They have an anomalous rotational band, characterized by the parameters $3\hbar^2/J$ and a. The magnetic moments and the M1-transition probabilities between rotational levels with K = 1/2 are not only functions of the gyromagnetic ratios of the single-particle and collective motion g_K and g_R, but also of the parameter b. It holds that

$$\mu(I) = \frac{1}{4(I+1)} (g_K - g_R) \left[1 - (2I+1)(-1)^{I-1/2} b\right] + I g_K \quad \text{and}$$

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$B(M1, I+1 \rightarrow I) = \frac{3}{64\pi}\left(\frac{e\hbar}{2Mc}\right)^2 \frac{2I+1}{I+1}(g_K - g_R)^2 \left[1 + b(-1)^{I-1/2}\right]^2$. The nuclear magnetic moment in the ground state of the band $I = K = \Omega = 1/2$ reads for $K = \frac{1}{2}^+$: $3\mu_0 = g_K + g_R(1-a) - g_l(1-a) + g_s/2$ - (3), and for $K = \frac{1}{2}^-$: $3\mu_0 = g_R(1-a) + g_l(1-a) - g_s/2$ - (4), where g_s and g_l denote the spin- and orbital gyromagnetic ratio of the unpaired proton or neutron. It may be assumed that $g_s = 5.58$ (proton) and -3.82 (neutron), $g_l = 1$ (proton), $g_l = 0$ (neutron). The values of g_s and g_l may deviate considerably in the nucleus from those given here for free nucleons. The authors show that such a renormalization of the gyromagnetic ratios g_s and g_l is necessary to explain the experimental μ_0 values of the nuclei Yb^{171} and W^{183}. For Tu^{169}, as already shown in Ref. 4, relation (3) is satisfied with non-renormalized g_s and g_l and $g_R = Z/A$. All hitherto known rotational band nuclei with $K = 1/2$ (Tu^{169}, Yb^{171}, W^{183}, and Pu^{239})

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With K = 1/2

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are investigated again. For a first example Tu^{169}: it is found that also when making use of new and complete data, no renormalization of g_s and g_1 is necessary. The same holds for Pu^{239}. Yb^{171} and W^{183} have rotational bands with $K = \frac{1}{2}^{-}$. Here, g_R may be obtained from (4) only if renormalized g_s and g_1 are used. One obtains $g_R = -4.0$ and not $+0.40$ as would result from Z/A. The fact that (4) is not satisfied might be caused by the change in the parameter a due to a shift of the rotational bands K = 1/2 and K = 3/2. This change of a, however, is not so great as to explain the experimental μ_0 value without renormalization of g_s and g_1. Much the same holds for conditions with W^{183}. While $g_R = +0.28$ is obtained experimentally, (4) yields $g_R = -1.9$. It is therefore necessary for these two nuclei to renormalize the g_s and g_1 of the nucleons. Values of these parameters, with which (4) is satisfied, are given. An appendix offers experimental data concerning these four nuclei. D. F. Zaretskiy and A. V. Shut'ko are mentioned in a footnote. There are 13 references, 4

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3 of which are Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy fizicheskiy institut Leningradskogo gos. universiteta im. A. A. Zhdanova (Scientific Research Institute of Physics of Leningrad State University imeni A. A. Zhdanov)

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85594

S/048/60/024/007/028/032/XX
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24,4500

AUTHOR: Varshalovich, D. A.

TITLE: Experimental and Theoretical Coefficients of the Mixture of the States and of the Polarization of Nucleons in Deformed Nuclei

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 7, pp. 895-898

TEXT: This paper was read at the 10th All-Union Conference on Nuclear Spectroscopy, which took place from January 19 to January 27, 1960 at Moscow. As is known, the state of a nucleon in an axially deformed nucleus without $(\vec{l} - \vec{s})$-coupling may be characterized by the quantum numbers Σ, Λ, and Ω. Σ, Λ, and Ω are the projections of $\vec{s}$, $\vec{l}$, and $\vec{j}$ on the symmetry axis of the nucleus. As $\vec{s} + \vec{l} = \vec{j}$, $\Sigma + \Lambda = \Omega$ holds. In the case of an $(\vec{l}-\vec{s})$-interaction the state with the same Ω is displaced to different Σ and Λ. The wave function of a nucleon in the deformed nucleus may thus be represented as a superposition of two functions:

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$\psi(\Omega) = \alpha\phi^{+} + \beta\phi^{-}$ (1). α^2 and β^2 are the probabilities for the nucleon being found in one or the other state. The polarization of a nucleon in a deformed nucleus is calculated from twice the mean value of the projection of the spin onto the symmetry axis of the nucleon; $P = 2\langle\vec{s}\rangle = \alpha^2 - \beta^2$; $-1 \leq P \leq 1$ (2). Using the wave function of Nilsson, α, β, and P may be calculated. The author mentions various reasons why the wave functions of a real nucleus differ considerably from the Nilsson wave function. 1) The main assumption of the Nilsson model concerning the axial symmetry of the nuclear field is not satisfied. 2) In a coupling of the motion of a particle and the collective motion, a shift of Nilsson's configuration occurs. 3) The residual pair interaction of the nucleons also leads to a change in the wave function. 4) The parameters characterizing the selfconsistent nuclear field were not selected by Nilsson with sufficient accuracy. 5) The wave functions depend on nuclear deformation. It is, therefore, of great interest to make a comparison between the theoretically and experimentally determined P, α, and β. Determinations of P, α and β are briefly discussed on the basis of experimentally accessible

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quantities. The results obtained are given in Tables 1 (nuclei with odd Z) and Table 2 (nuclei with odd N). From the discussion of these results, the author draws the conclusions that the Nilsson functions show satisfactory agreement with the experiment, that the state classification according to the asymptotic quantum numbers is purposeful, and that the selection rule for Λ and Σ is necessarily satisfied. There are 2 tables and 5 references: 1 Soviet, 2 Danish, and 1 US.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut Akademii nauk SSSR (Leningrad Institute of Physics and Technology of the Academy of Sciences, USSR)

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Table 1. Nuclei with odd Z

Ядро	J*	μ, я. м.*	$g\Omega$**	$f_{эксп}$	$\lvert\alpha_{эксп}\rvert$	$\lvert\beta_{эксп}\rvert$	δ	$\lvert\alpha_{теор}\rvert$	$\lvert\beta_{теор}\rvert$	Ω	π	[Nn_z ΛΣ]
1	2	3	4	5	6	7	8	9	10	11	12	13
$_{11}Na^{23}$	3/2	+2,217	(+2,15)	+0,75	0,94	0,35	0,37	0,97	0,27	3/2	+	[211+]
$_{13}Al^{27}$	5/2	+3,641	(+1,89)	+0,93	0,98	0,19	0,35	1,00	0,00	5/2	+	[202+]
$_{63}Eu^{153}$	5/2	+1,5	+0,65	−0,38	0,56	0,83	0,30	0,36	0,93	5/2	+	[413−]
$_{65}Tb^{159}$	3/2	(+) 1,52	+1,49	+0,32	0,81	0,58	0,31	0,94	0,35	3/2	+	[411+]
$_{67}Ho^{165}$	7/2	(+) 3,31	+1,12	+0,18	0,77	0,64	0,30	0,95	0,32	7/2	−	[523+]
$_{69}Tu^{169}$	1/2	−0,20 (3)	−2,20	−0,70	0,39	0,92	0,28	0,40	0,92	1/2	+	[411−]
$_{71}Lu^{175}$	7/2	+2,0	+0,66	−0,52	0,49	0,87	0,28	0,22	0,98	7/2	+	[404−]
$_{73}Ta^{181}$	7/2	+2,1	+0,70	−0,46	0,52	0,85	0,23	0,24	0,97	7/2	+	[404−]
$_{73}Ta^{181m}$	5/2	+3,0 (3)	(+1,52	+0,57	0,89	0,46	0,23	0,98	0,22	5/2	+	[402+]
$_{75}Re^{185}$	5/2	+3,171	+1,55	+0,60	0,90	0,45	0,19	0,97	0,25	5/2	+	[402+]
$_{75}Re^{187}$	5/2	+3,176	+1,55	+0,60	0,90	0,45	0,19	0,97	0,25	5/2	+	[402+]
$_{77}Ir^{191}$	3/2	+0,16	(−0,09)	−0,71	0,38	0,93	0,14	0,24	0,97	3/2	+	[402−]
$_{77}Ir^{193}$	3/2	+0,17 (3	(−0,08	−0,71	0,38	0,93	0,12	0,28	0,96	3/2	+	[402−]
$_{93}Np^{237}$	5/2	(+) 6,0 (2,5)	(+3,20)	+2,40	—	—	0,25	0,90	0,45	5/2	+	[642+]
$_{93}Np^{237m}$	5/2	+2,0	(+0,96)	−0,05	0,69	0,73	0,25	0,48	0,88	5/2	−	[523−]
$_{95}Am^{241}$	5/2	(+) 1,4	(+0,63)	−0,30	0,59	0,81	0,27	0,47	0,89	5/2	−	[523−]
$_{95}Am^{243}$	5/2	(+) 1,4	(+0,63)	−0,30	0,59	0,81	0,27	0,47	0,89	5/2	−	[523−]

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Table 2. Nuclei with odd N

Ядро 1	J* 2	μ, I * 3	g_Ω ** 4	$P_{эксп}$ 5	$\lvert\alpha_{эксп}\rvert$ 6	$\lvert\beta_{эксп}\rvert$ 7	δ 8	$\lvert\alpha_{теор}\rvert$ 9	$\lvert\beta_{теор}\rvert$ 10	Ω 11	π 12	$[Nn_z\Lambda\Sigma]$ 13
$^{21}Ne_{11}$	3/2	−0,5 (1)	(−0,89)	+0,70	0,92	0,39	0,37	0,98	0,22	3/2	+	[211+]
$^{25}Mg_{13}$	5/2	−0,855	(−0,67)	+0,80	0,95	0,32	0,36	1,00	0,00	5/2	+	[202+]
$^{155}Gd_{91}$	3/2	−0,32	(−0,63)	+0,50	0,87	0,50	0,31	0,91	0,42	3/2	—	[521+]
$^{157}Gd_{93}$	3/2	−0,37 (4)	(−0,69)	+0,54	0,88	0,48	0,31	0,91	0,42	3/2	—	[521+]
$^{161}Dy_{95}$	5/2	−0,38 (5)	(−0,38)	+0,50	0,87	0,50	0,30	0,88	0,47	5/2	—	[752+]
$^{163}Dy_{97}$	5/2	+0,53 (5)	+0,18	−0,24	0,62	0,79	0,30	0,44	0,90	5/2	+	[523−]
$^{167}Er_{99}$	7/2	−0,5 (1)	(−0,30)	+0,55	0,88	0,47	0,29	0,93	0,37	7/2	+	[633+]
$^{171}Yb_{101}$	1/2	+0,43 (5)	+1,38	−0,36	0,57	0,82	0,28	0,48	0,88	1/2	—	[521−]
$^{173}Yb_{103}$	5/2	−0,67 (5)	(−0,53)	+0,70	0,92	0,39	0,28	0,94	0,33	5/2	—	[512+]
$^{177}Hf_{105}$	7/2	+0,61 (3)	+0,20	−0,37	0,56	0,83	0,27	0,32	0,94	7/2	—	[514−]
$^{179}Hf_{107}$	9/2	−0,47 (3)	−0,20	+0,48	0,86	0,51	0,26	0,96	0,30	9/2	+	[624+]
$^{183}W_{109}$	1/2	+0,118	+0,16	−0,04	0,69	0,72	0,21	0,92	0,41	1/2	—	[510+]
$^{189}Os_{113}$	3/2	+0,656	(+0,46)	−0,36	0,57	0,83	0,16	0,46	0,89	3/2	—	[512−]
$^{233}U_{141}$	5/2	(+) 0,51	+0,13	−0,17	0,64	0,77	0,24	0,57	0,82	5/2	+	[633−]
$^{235}U_{143}$	7/2	(−) 0,34	−0,23	+0,42	0,84	0,54	0,24	0,91	0,42	7/2	—	[743+]
$^{241}Pu^{147}$	5/2	(−) 1,4	(−0,94)	+1,23?	—	—	0,27	0,90	0,44	5/2	+	[622+]

Legend to Tables 1 and 2: 1) Nucleus, 2) J, 3) μ, 4) g_Ω, 5) F_{exp}, 6) $|\alpha_{exp}|$, 7) $|\beta_{exp}|$, 8) Deformation parameter δ, 9) $|\alpha_{theor}|$, 10) $|\beta_{theor}|$, 11) Ω, 12) π, 13) $[Nn_z\Lambda\Sigma]$

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VARSHALOVICH, D.A.

Probabilities of electromagnetic transitions and static moments of odd-odd atomic nuclei. Zhur. eksp. i teor. fiz. 38 no.1:172-179 Jan '60. (MIRA 14:9)

1. Leningradskiy fiziko-tekhnicheskiy institut AN SSSR.
(Nuclei, Atomic) (Dipole moments)

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B006/B070

24.4500

AUTHOR: Varshalovich, D. A.

TITLE: Probabilities for Rotational γ-Transitions 19 of the E2 Type and the Quadrupole Moments of the Deformed Nuclei With K = 1 and 1/2 19

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 2(8), pp. 461 - 462

TEXT: The author has studied the anomalies of the quadrupole moment Q of deformed nuclei and the reduced probabilities B for E2 γ-transitions between the levels of the rotational band in the case of K=1 and K=1/2 (K - projection of the total angular momentum on the nuclear symmetry axis). For these K values Q and B(E2) depend not only on the internal quadrupole moment $Q_0 \equiv \langle \chi_K | \hat{Q} | \chi_K \rangle$ but also on the matrix element $\langle \chi_{-K} | \hat{Q} | \chi_K \rangle$ ($\hat{Q}$ - operator of the quadrupole moment; χ_K a function characteristic of the inner state of the nucleus). The anomalies in Q and B(E2) in nuclei with K=1 and 1/2 are similar to the known anomalies in the magnetic

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Probabilities for Rotational γ-Transitions of the E2 Type and the Quadrupole Moments of the Deformed Nuclei With K = 1 and 1/2

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moments μ and the reduced rotational transition probabilities B(M1) in nuclei with K = 1/2, which are due to the equivalence of positive and negative directions of the nuclear axis. For the quadrupole moments and the probabilities, the following relations are obtained (I - nuclear spin):

$K = 1$: $Q = Q_o \dfrac{3 - I(I+1)[1+(-1)^I 3b_o]}{(I+1)(2I+3)}$; ground state, I = K = 1:
$Q = Q_o(1+6b_o)/10$. $b_o = \langle\chi_{-1}|\hat{Q}|\chi_1\rangle / \langle\chi_1|\hat{Q}|\chi_1\rangle$.

Transition $I + 1 \rightarrow I$: $B(E2) = \frac{5}{16\pi} e^2 Q_o^2 (C^{IK}_{I+1K;20})^2 [1-(-)^{I-K}(I+1)b_o]^2$

Transition $I + 2 \rightarrow I$: $B(E2) = \frac{5}{16\pi} e^2 Q_o^2 (C^{IK}_{I+2K;20})^2 [1+(-)^{I-K} b_o]^2$

$C^{\cdot\cdot}_{\cdot\cdot\cdot}$ - Clebsch-Gordan coefficients. In the ground state I=K=1/2, Q=0. The B(E2) for transitions with K = 1/2 are analogous; only the I- and K-values are different, and b_o is the ratio of the matrix elements denoted by the index 1/2. The sign and magnitude of b_o are determined by the inner

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Probabilities for Rotational γ-Transitions of the E2 Type and the Quadrupole Moments of the Deformed Nuclei With K = 1 and 1/2

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state of the nucleus. b_o values are experimentally known only for 5 deformed nuclei which have states with K=1 and 1/2. These values are collected in a table and compared with those obtained theoretically. The agreement is satisfactory only for Yb^{171} and Tm^{169}. There are 1 table and 9 references: 3 Soviet, 5 US, and 1 Dutch.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut Akademii nauk SSSR (Leningrad Institute of Physics and Technology of the Academy of Sciences, USSR)

SUBMITTED: March 21, 1960

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S/048/61/025/001/014/031
B029/B060

24.6510

AUTHOR: Varshalovich, D. A.

TITLE: Probabilities of gamma transitions in odd - odd deformed nuclei

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 1, 1961, 77-82

TEXT: Only such cases are examined in the present paper as exhibit a low residual interaction between protons and neutrons, and in which $\alpha_i^2 \ll \alpha_o^2$, and where the levels of the odd-odd nucleus may be characterized by certain values of the quantum states Ω_p^π, Ω_n^π, and K. In such a classification of the states the gamma transitions in odd-odd nuclei can be subdivided into three groups: 1) transitions between the levels of a single rotational band: $\Omega_p^1 = \Omega_p^2$, $\Omega_n^1 = \Omega_n^2$, $K^1 = K^2$. 2) Transitions X

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between the levels of a doublet or between their rotational bands: $\Omega^1_p = \Omega^2_p, \Omega^1_n = \Omega^2_n$, $K^1 \neq K^2$. 3) Transitions between different doublets, namely, one-particle transitions $\Omega^1_\alpha \neq \Omega^2_\alpha$, $\Omega^1_\beta = \Omega^2_\beta$, $K^1 \neq K^2$ and two-particle transitions: $\Omega^1_\alpha \neq \Omega^2_\alpha$, $\Omega^1_\beta \neq \Omega^2_\beta$, $K^1 \neq K^2$. All of these types are dealt with in the present paper. The properties of odd-odd nuclei (spins and parities of states, probabilities of gamma transitions, electric and magnetic moments) can be directly brought in connection with the properties of adjacent odd nuclei, if the residual interaction of the nucleons is small, and the odd-odd nuclei are as much deformed as the adjacent odd nuclei. The electric quadrupole moment of a deformed nucleus can be calculated according to formula

$Q(I) = Q_o \frac{3K^2 - I(I+1)}{(I+1)(2I+3)}$. Here, I denotes the angular momentum and K its projection on the axis of symmetry. Table 1 contains the magnetic moments of the ground states of the rotational bands (I = K) and the

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reduced probabilities of gamma transitions of the M1 type ($I_1 = K + 1 \rightarrow I_2 = K$). To evaluate the magnetic moments and the probabilities of the rotational transitions of the M1 type in an odd-odd nucleus it is necessary to calculate $g_K = \frac{g_{\Omega_1}\Omega_1 \pm g_{\Omega_2}\Omega_2}{\Omega_1 \pm \Omega_2}$ from adjacent nuclei and to write $g_R = Z/A$. The values of μ and of the probability B in odd-odd nuclei change markedly from nucleus to nucleus. Rotational transitions in odd-odd nuclei can therefore be almost pure M1 transitions or also almost pure E2 transitions in individual cases. A report follows, regarding the transitions between the levels of the doublets. In gamma transitions $K_1 = \Omega_1 + \Omega_2 \rightleftarrows K_2 = |\Omega_1 - \Omega_2|$ the states of the individual nucleons do not change, but there only takes place a relative re-orientation of the angular momenta of the unpaired proton and of the unpaired neutron. For the reduced probability of such a transition the following relation holds for $\Omega_1 > \Omega_2$:

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$$B(\sigma\lambda) = (C^{I_2K_2}_{I_2K_1;\lambda\mu})^2 \left| \langle \chi_{-\Omega_2} | \hat{m}_{\lambda\mu}(2) | \chi_{\Omega_2} \rangle \right|^2$$ and

$$B(\sigma\lambda) = (C^{I_2K_2}_{I_1K_2;\lambda\mu})^2 \left| \langle \chi_{-\Omega_1} | \hat{m}_{\lambda\mu}(1) | \chi_{\Omega_1} \rangle + \langle \chi_{-\Omega_2} | \hat{m}_{\lambda\mu}(2) | \chi_{\Omega_2} \rangle \right|^2$$

for $\Omega_1 = \Omega_2$. Between the ground states of the doublet there must occur gamma transitions of the magnetic multipolarity $\lambda = 2\Omega_2$, which can be mixed with transitions of the electric multipolarity $\lambda = 2\Omega_2 + 1$ (i.e. M1(E2), M3(E4), and M5(E6)). Gamma transitions with multiplicity $\lambda < 2\Omega_2$ are possible between the rotational bands of the doublets. They are, however, forbidden by the selection rules for K. A report is made of the transitions between the different doublets. The respective doublets mostly display a cascade-type de-excitation. The experimental data available are not yet sufficient for a thorough checking of the relations derived here. The magnetic moments have so far been measured

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only on six odd-odd deformed nuclei (Table 2). While experimental and theoretical values in Eu^{152} and Eu^{154} differ by only 30%, they are in good agreement in the other isotopes. The article under consideration is the reproduction of a lecture delivered at the 10th All-Union Conference on Nuclear Spectroscopy, which took place in Moscow from January 19 to 27, 1960. There are 2 tables and 8 references: 5 Soviet-bloc and 5 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk SSSR (Institute of Physics and Technology, Academy of Sciences USSR)

Legend to Table 1: 1) nucleus, 2) proton, 3) neutron, 4) μ in nuclear magnetons.

Legend to Table 2: Magnetic moments of odd-odd deformed nuclei 1) nucleus, 2) μ_{exp} in nuclear magnetons, 3) μ_{theor} in nuclear magnetons.

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Probabilities of gamma transitions...

Магнитные моменты основных состояний ротационных полос ($I=K$) и приведенные вероятности γ-переходов типа $M1$ ($I_1=K+1\to I_2=K$)

Ядро	Протон		Нейтрон		$\Omega_1+\Omega_2$			$\Omega_1-\Omega_2$		
	Ω^π	g_Ω	Ω^π	g_Ω	K_1^π	μ, яд. м.	$B(M1)$ (яд. м.)²	K_2^π	μ, яд. м.	$B(M1)$ (яд. м.)²
${}_{11}Na^{22}_{11}$	$3/2^+$	+2,15	$3/2^+$	−0,89	3^+	+1,79	$0,7\cdot10^{-2}$	0^+	0	—
${}_{11}Na^{24}_{13}$	$3/2^+$	+2,15	$5/2^+$	−0,67	4^+	+1,65	$3,0\cdot10^{-3}$	1^+	−2,20	2,06
${}_{13}Al^{26}_{13}$	$5/2^+$	+1,89	$5/2^+$	−0,67	5^+	+2,96	$0,9\cdot10^{-2}$	0^+	0	—
${}_{63}Eu^{152}_{89}$	$5/2^+$	+0,65	$3/2^-$	−0,60	4^- эксп 3^-	+0,91	$3,4\cdot10^{-2}$	1^-	+1,47	0,32
${}_{63}Eu^{154}_{91}$	$5/2^+$	+0,65	$3/2^-$	−0,62	4^- эксп 3^-	+0,88	$3,3\cdot10^{-2}$	1^-	+1,48	0,32
${}_{65}Tb^{156}_{91}$	$3/2^+$	+1,49	$3/2^-$	−0,60	3^-	+1,31	$3,4\cdot10^{-4}$	0^-	[+0,42]	—
${}_{65}Tb^{158}_{93}$	$3/2^+$	+1,49	$3/2^-$	−0,62	3^-	+1,29	$2,5\cdot10^{-4}$	0^-	[+0,41]	—
${}_{65}Tb^{160}_{95}$	$3/2^+$	+1,49	$5/2^-$	−0,38	4^-	+1,36	$4,6\cdot10^{-4}$	1^-	−1,39	0,93
${}_{67}Ho^{160}_{93}$	$7/2^-$	+1,12	$3/2^-$	−0,62	5^+	+2,84	$2,5\cdot10^{-2}$	2^+	+3,50	0,92
${}_{67}Ho^{162}_{95}$	$7/2^-$	+1,12	$5/2^-$	−0,38	6^+	+2,10	$7,2\cdot10^{-3}$	1^+	+2,64	1,43
${}_{67}Ho^{164}_{97}$	$7/2^-$	+1,12	$5/2^+$	+0,1[illegible]	6^-	+4,10	0,10	1^-	+1,94	0,67
${}_{67}Ho^{166}_{99}$	$7/2^-$	+1,12	$7/2^+$	−0,25	7^-	+3,02	$1,2\cdot10^{-2}$	0^-	[+0,40]	—
${}_{69}Tu^{168}_{99}$	$1/2^+$	−2,20	$7/2^+$	−0,25	4^+	−1,25	0,51	3^+	+0,48	$4,6\cdot10^{-2}$

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B117/B212

AUTHORS: Varshalovich, D. A., Peker, L. K.

TITLE: Peculiarities of deformed odd-odd nuclei with K = 0

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 2, 1961, 287-295

TEXT: The present paper was read at the 11th Annual Conference on Nuclear Spectroscopy (Riga, January 25 to February 2, 1961). Preliminary results of the work, concerning peculiarities of Am^{242}, Ta^{180*}, and Lu^{176*} have been reported on at the 10th All-Union Conference on Nuclear Spectroscopy (Moscow, 1960). The paper mainly deals with the properties of rotational levels of odd-odd nuclei. It is pointed out that all conclusions also pertain to excited states of even-even nuclei with non-paired nucleons. It was shown that the inner wave functions describing the levels of a certain rotational band will differ from that of levels with one even and one odd spin I, despite the equal states of odd neutrons and protons. It follows therefrom that these rotational levels with even and odd spins are shifted with respect to each other. Due to the dependence of E_0 on I it is shown that

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with B<A the level with $I = 0$ is the lowest level of the band with $K = 0$. For the case of A<B, if the rotational level is of the type $I = 1$, $K = 0$ must be below $I = 0$ (Fig. 1b). This was studied on odd-odd nuclei the spin of which was $I = 1$ (according to experimental (direct or indirect) data (Refs. 2 and 3) (Table 1). For cases examined, the I-, L-, and K-values were known. For the initial state with $I = 1$, two possible values $K = 0$ and $K = 1$ must be considered, since the relations of the beta-transition probabilities mentioned are very sensitive to an exchange of $K = 0$ for $K = 1$. Therefore, the K-value of an odd-odd nucleus may definitely be determined by relatively rough measurements of the intensities of both beta transitions. The absolute values may be predicted, and the signs of the quadrupole moments Q, and the magnetic dipole moments μ of these states can be determined for nuclei for which the condition A<B is fullfilled. if the ground state or the isomeric state has $I = 1$ but $K = 0$. The multipole gamma-transition probability L between the rotational level of bands having the spin I_1 and I_2, and $K = 0$ can be represented by

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$$B(L) = \left[\langle \chi^{d}_{\Omega}(p)\chi^{\beta}_{-\Omega}(n)|\hat{W}|\chi^{d}_{\Omega}(p)\chi^{\beta}_{-\Omega}(n)\rangle \cdot (1 + (-)^{\Delta I+L})\right]^2 \langle I_1 L00|J_1 LI_2 0\rangle^2 \quad (12).$$

For gamma transitions between levels with even (or odd) spins $\Delta I = I_2 - I_1 = 2$, the above formula assumes the form

$B(E2) = \frac{5}{16\pi} e^2 Q_0^2 \langle I_1 L00|I_1 LI_2 0\rangle^2$, for rotational levels of even-even nuclei (Ref. 1). For transitions between the rotational levels I + 1 and I, it reads B(E2); I + 1 → I) = 0. These transitions, however, must be pure M_1-dipole transitions. The results obtained hold not only for transitions between the levels of two different rotational bands with K = 0 but also for transitions between the levels of two different rotational bands with K = 0±. If the odd proton and neutron of a light nucleus are in the same quantum state ($\chi^{d}_{\Omega p} = \chi^{\beta}_{\Omega n}$), the bands with K = 0 show additional peculiarities. In this case, isotopic spin formalism may be applied. Actually, there are two such functions in this case: 1) The coordinate-spin part is antisymmetric, the isotopic-spin part is symmetric; 2) Vice versa. The first wave function corresponds to $I = 1^+, 3^+, 5^+ \ldots$ and is characterized by the isotopic spin $T = 0$. The second wave function corresponds to the group of levels with an even spin $I = 0^+, 2^+, 4^+ \ldots$ and is characterized by $T = 1$. Fig. 3 shows experimental data for some excited states of ${}_{11}Na^{22}_{11}$ (Refs. 26 and 27), and ${}_{13}Al^{26}_{13}$ (Ref. 26), which can be explained as rotational levels and follow these conclusions. The peculiarities mentioned for rotational bands with $K = 0$ in odd-odd nuclei are caused by the fact that in these nuclei odd nucleons are in different quantum states. A similar situation is observed in even-even nuclei, if during excitation the linkage of one of the neutron-proton pairs is disrupted. Like in the case of odd-odd nuclei, the rotational bands corresponding to such a state of even-even nuclei must contain groups of levels with even and odd spins which are shifted with respect to each other. This peculiarity of "single-body" levels for even-even nuclei with $K = 0$ distinguishes them from the collective states for $K = 0$. In Refs. 29 and 30, similar results are given. There are 3 figures, 2 tables, and 30 references: 8 Soviet-bloc.

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Peculiarities of deformed ...

ASSOCIATION: Nauchno-issledovatel'skiy fizicheskiy institut Leningradskogo gos. universiteta im. A. A. Zhdanova (Scientific Research Institute of Physics of the Leningrad State University imeni A. A. Zhdanov)
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Legend to Table 1: 1) parent and daughter nuclei; 2) type of the transition; 3) experimental values; 4) theoretical values.

Таблица 1

β-распад нечетно-нечетных ядер с $I=1$ на уровни дочерних ядер с $I=0^+$ и 2^+ [3, 4]

Исходное и дочернее ядра 1	Тип перехода 2	$\lg ft_{эксп}$ 3	$A^*_{эксп}$ 3	$A_{теор.}$ $K=1$ 4	$A_{теор.}$ $K=0$ 4
${}_{67}Ho^{164}_{97} \xrightarrow{\beta^-} {}_{68}Er^{164}_{96}$	$1^+ \to 0^+$ $1^+ \to 2^+$	6,4 6,7	+0,3	+0,3	−0,3
${}_{69}Tu^{170}_{101} \xrightarrow{\beta^-} {}_{70}Yb^{170}_{100}$	$1^- \to 0^+$ $1^- \to 2^+$	8,9 9,3	+0,4	+0,3	−0,3

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$_{73}Ta^{180}_{107} \xrightarrow{\beta^-} {}_{74}W^{180}_{106}$	$1^- \to 0^+$ $1^- \to 2^+$	6,8 6,5	−0,3	+0,3	−0,3
$_{75}Re^{186}_{111} \xrightarrow{\beta^-} {}_{76}Os^{186}_{110}$	$1^- \to 0^+$ $1^- \to 2^+$	7,7 8,0	+0,3	+0,3	−0,3
$_{75}Re^{188}_{113} \xrightarrow{\beta^-} {}_{76}Os^{188}_{112}$	$1^- \to 0^+$ $1^- \to 2^+$	8,1 8,6	+0,5	+0,3	−0,3
$_{93}Np^{236}_{143} \xrightarrow{\beta^-} {}_{94}Pu^{236}_{142}$	$1^- \to 0^+$ $1^- \to 2^+$	6,8 7,1	+0,3	+0,3	−0,3
$_{93}Np^{236}_{143} \xrightarrow{\varepsilon} {}_{92}U^{236}_{144}$	$1^- \to 0^+$ $1^- \to 2^+$	~7,2 ~7,7	~+0,5	+0,3	−0,3
$_{95}Am^{242}_{147} \xrightarrow{\beta^-} {}_{96}Cm^{242}_{146}$	$1^- \to 0^+$ $1^- \to 2^+$	7,1 6,8	−0,3	+0,3	−0,3
$_{95}Am^{242}_{147} \xrightarrow{\varepsilon} {}_{94}Pu^{242}_{148}$	$1^- \to 0^+$ $1^- \to 2^+$	~7,6 ~7,3	~−0,3	+0,3	−0,3

* $A = (\lg ft)_{2+} - (\lg ft)_{0+}$.

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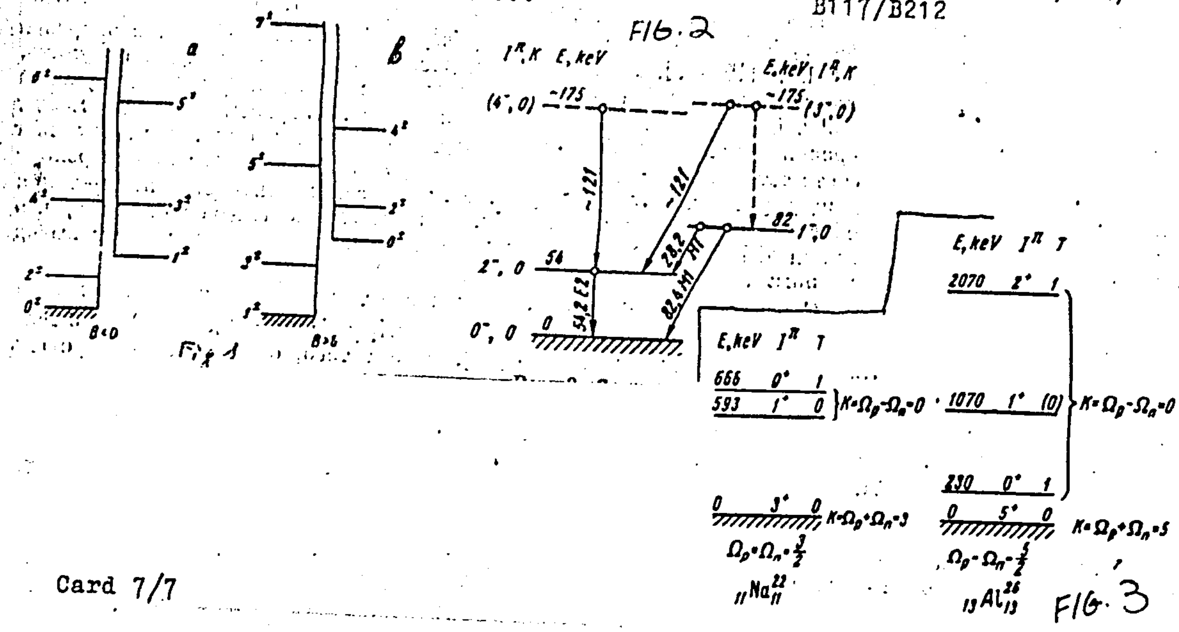

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ACCESSION NR: AP4024051 S/0048/64/028/002/0275/0286

AUTHOR: Varshalovich, D.A.

TITLE: Investigation of the fine and hyperfine structure of nuclear spectra /Report, Fourteenth Annual Conference on Nuclear Spectroscopy held in Tbilisi 14 to 22 Feb 1964/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.2, 1964, 275-286

TOPIC TAGS: nuclear spectrum, nuclear level splitting, nuclear spectrum fine structure, nuclear spectrum hyperfine structure, interference effect, polarization effect, nuclear spectrometry

ABSTRACT: Nuclear radiation spectra have fine and hyperfine structure, analogous to the familiar fine and hyperfine structure exhibited by atomic spectra. The magnitude of the splitting (10^{-5} to 10^{-7} eV) in many cases ($\tau > 10^{-8}$ sec) is substantially greater than the natural line width, but in practice the hyperfine structure cannot be resolved even with the aid of instruments with ideal resolution, owing to line broadening due to thermal motion of the nuclei. Discovery of the Mossbauer effect opens possibilities for direct investigation of the natural form of γ-lines and

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ACCESSION NR: AP4024081

their hyperfine splitting. However, the procedure based on the Mossbauer effect is applicable only to γ-rays and only to a limited number of transitions. There is, however, another method for investigating nuclear spectra, which makes it possible to eliminate the effect of Doppler broadening, and to study the natural line shape and width, and hyperfine splitting. Actually one of the variants of this method has been used in nuclear physics since 1952 (K.Alder, Helv.phys.acta,25,235,1952); this is the method of so-called angular correlation in a magnetic field. The usual experiments, however, do not utilize the full possibities of the method. The idea fundamental to the method is the following. If the levels of the given system are split and in de-excitation of the excited state E_0 there may occur transitions both to level E_1' and to level E_1'', the wave function (potential) of the emitted photon or particle will consist of a superposition of two frequencies:

$$\omega_1 = \frac{E_0 - E_1'}{\hbar} \quad \text{and} \quad \omega_2 = \frac{E_0 - E_1''}{\hbar}, \qquad \psi = a_\varphi(r) e^{-i(\omega_1 t - k_1 r)} + b_\varphi(r) e^{-i(\omega_2 t - k_2 r)},$$

where t is the instant and r is the point of observation with respect to the internal system of coordinates, k_1 and k_2 are the wave vectors corresponding to the radiations ω_1 and ω_2. Interference of these vibrations gives rise to beats, i.e., to

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ACCESSION NR: AP4024051

periodic variations in intensity with a frequency equal to the difference between the above two frequencies. The paper is devoted to theoretical analysis of the possibilities and potentialities of variants of the method, taking into account polarization and other factors. Experimental arrangements (difference and resonance procedures) for investigating hyperfine structure of nuclear lines are proposed. It is suggested that the resonance arrangement is particularly convenient in cases when it is desired to separate a group of close frequencies; such a situation obtains, for example, when the splitting of the nuclear levels is due to both dipole magnetic and quadrupole electric interaction, but one of these predominate. "In conclusion, I would like to express my deep gratitude to Doctor of Physical-Mathematical Sciences A.Z.Dolginov and E.B.Aleksandrov for useful discussions." Orig. art.has: 13 formulas, 6 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 00Jul63 DATE ACQ: 08Apr64 ENCL: 00

SUB CODE: NS NR REF SOV: 003 OTHER: 002

ACCESSION NR: AP4024067 S/0048/64/028/002/0396/0399

AUTHOR: Varshalovich, D.A.

TITLE: Interference of events in time /Report, Thirteenth Annual Conference on Nuclear Spectroscopy held in Kiev 25 Jan to 2 Feb 1963/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.2, 1964, 396-399

TOPIC TAGS: time interference, particle detection, diffraction, spatial interference

ABSTRACT: The paper presents a theoretical analysis of interference of events in time. There is considered the hypothetical experiment diagramed in the figure (Enclosure). The nuclei of the source emit particles or photons r_1 and r_2 as a result of a cascade transition. An energy analyzer with high resolution determines the energy of the particles r_2. The time selector gate passes the particles (or the corresponding pulses) to the analyzer only in definite time intervals determined with respect to the time at which r_1 is counted. Essentially this is a delayed coincidence circuit for r_1 and r_2 with a resolving time τ and a delay time θ. Equations are written to determine $I_1(E)$, the number of r_2 particles arriving per unit time with energy between E and $E + \epsilon$, within the time interval θ_1 to $\theta_1 + \tau$, relative to r_1;

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$I_2(E)$, the number of r_2 particles per unit time with energy between E and $E + \epsilon$ arriving at the analyzer in the time interval θ_2 to $\theta_2 + \tau$ relative to r_1; and $I_{12}(E)$, the number of r_2 particles with the same energy (E to $E + \epsilon$) arriving at the analyzer during both time intervals. The intensities, in general, will not be additive, i.e., $I_{12}(E) \neq I_1(E) + I_2(E)$, owing to interference. It is demonstrated that there will occur an effect analogous to spatial diffraction, that is, that there will be an interference term in $I_{12}(E)$ due to the fact that each particle has a probability of being counted in both the first and the second time interval. Thus, in some respects interference of events in time is similar to ordinary interference arising in measurements of x and p. Accordingly, in considering interference of events in time one can deduce relations analogous to those obtaining in "spatial" diffraction and interference. It is hoped that with development of more precise energy measurement methods this effect will find practical applications. Possible experiments for observing the effect are suggested in general terms. Orig.art.has: 14 formulas and 2 figures.

ACCESSION NR: AP4024067

ASSOCIATION: Fizikoetekhnicheskiy institut im.A.F.Ioffe Akademii nauk SSSR (Physico-technical Institute, Academy of Sciences, SSSR)

SUBMITTED: 00 DATE ACQ: 08Apr64 ENCL: 01

SUB CODE: PH, NS NR REF SOV: 000 OTHER: 000

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ACCESSION NR: AP5015582 UR/0033/65/042/003/0557/0567
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B

AUTHOR: Varshalovich, D. A.

TITLE: Orientation of atoms and molecules by resonance radiation in outer space

SOURCE: Astronomicheskiy zhurnal, v. 42, no. 3, 1965, 557-567

TOPIC TAGS: spin, orientation, interplanetary space, atom, molecule

ABSTRACT: The orientation of atoms and molecules of gas by resonance radiation, as well as associated effects, must be considered when investigating the medium of interstellar space, gaseous nebulae, and the stellar atmosphere. This phenomenon of orientation may be detected by studying polarization of the radiation or by observing the structure and dynamics of the gaseous envelope. The spins of molecules, atoms, and ions in a rarefied gas are oriented in a stream of radiation because of the anisotropic angular distribution of the radiation. The mechanism of resonance orientation with time is analyzed. These results are obtained on the assumption that no magnetic field is present and that there is no collision between atoms. Probabilities of collisions are then examined, and the magnitudes of the magnetic field at various points in space are considered, the

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relation of direction of magnetic field to direction of incident radiation is analyzed for its effect on the Larmor procession and the consequent effect on orientation of particles. In the computation only one resonance transition was taken into account, but all resonance transitions should be included. "In conclusion, I express my sincere thanks to A. Z. Dolginov, doctor of physical and mathematical sciences, for his useful discussions." Orig. art. has: 3 figures, 2 tables, and 20 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy in-t im. A. F. Ioffe Akademii nauk SSSR (Physico-Technical Institute, Academy of Sciences SSSR)

SUBMITTED: 15Jul64 ENCL: 00 SUB CODE: AA, NP

NO REF SOV: 000 OTHER: 002

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L 13038-66 EWT(m) DIAAP

ACC NR: AP6002678 SOURCE CODE: UR/0048/65/029/012/2173/2176

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B

AUTHOR: Varshalovich, D.A.

ORG: Physico-technical Institute im. A.F.Ioffe, Academy of Sciences SSSR (Fiziko-tekhnicheskiy institut Akademii nauk SSSR)

19,55

TITLE: Possibility of realizing a system of directed nuclear radiation /Report, Conference on Nuclear Spectr. & Nuclear Structure held in Minsk 25 Jan.-2 Feb.1965/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 29, no. 12, 1965, 2173-2176

TOPIC TAGS: nuclear radiation, angular distribution, resonance scattering, electromagnetic beam, Mössbauer effect.

ABSTRACT: It is pointed out that the angular distribution of nuclear radiation can be altered by associating with the radiating nucleus a second nucleus capable of resonantly scattering the emitted radiation. Since the phase of the scattering amplitude changes when the energy passes through resonance, the resonant scatterer can be made to act in analogy with either the reflector or the director of a directional antenna. The necessary fixed geometric relation between radiator and scatterer can be assured by incorporating the two nuclei in a molecule or a crystal lattice. One can employ a radioactive nucleus (e.g., Co^{57}) as radiator and its decay product (in this case Fe^{57}) as resonant scatterer. The desired small difference between the energy of the radiation and the resonant energy of the scatterer can be achieved by

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ACC NR: AP6002678

locating the two nuclei in different chemical environments, thus making use of the chemical shifts of the levels, or by so distorting the crystal mechanically as to produce suitable nonuniform internal fields. Fine adjustment of the distance between and scatterer can be achieved by exciting different vibrational levels of the molecule or by straining the crystal. From the measured angular distribution of the radiation from such a radiator - scatterer system, one can derive information similar to that obtainable from Mössbauer studies. The proposed technique is more advantageous than the Mössbauer effect in that it avoids disturbing relative vibrations between emitter and absorber and makes it possible to obtain information concerning not only the magnitudes of the matrix elements, but also their phases. Finally, and perhaps most important, the proposed technique offers the possibility of achieving directed beams of monochromatic gamma rays. The author thanks A.Z.Dolginov for a valuable discussion. Orig. art. has: 6 formulas and 3 figures. [15]

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ACC NR: AP6031987 SOURCE CODE: UR/0386/66/004/005/0180/0182

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AUTHOR: Varshalovich, D. A.

ORG: Physicotechnical Institute im. A. F. Ioffe, Academy of Sciences, SSSR (Fiziko-tekhnicheskiy institut Akademii nauk SSSR)

TITLE: Coherent amplification of radio emission in a cosmic medium

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 4, no. 5, 1966, 180-182

TOPIC TAGS: coherent signal, radio emission, cosmic radio source, laser emission coherence, quantum generator

ABSTRACT: It is shown that a level population inversion of the hyperfine structure of the ground state $1S_{1/2}$ takes place for hydrogen atoms placed in a guided beam of unpolarized ultraviolet radiation with a continuous spectrum in the region $\lambda \sim 1216 - 912$ Å. Values $T_{S0} = +5.2K$ and $T_{S\pm1} = -5.2K$ are obtained for the spin temperatures, under the assumption that the level populations are completely determined by the interaction between the atoms and the radiation, and that collisions play no role. Since such a situation is characteristic of many regions of interstellar medium, especially near radiation sources, it is proposed that cosmic radiation (for example, at $\lambda = 21$ cm, corresponding to the transition $T = 1 \rightarrow F = 0$ $(1S_{1/2})$), experience coherent amplification on passing through such a medium, i.e., the cosmic medium can act like a quantum amplifier or generator (maser). The radio-emission gain will depend on the fre-

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quency and the angle between the direction of the orienting radiation and the direction of propagation of the radio wave. Furthermore, such a situation should take place not only for H I atoms, but also for other atoms and molecules of the cosmic medium, particularly OH molecules. The difference between such a natural cosmic maser and the laboratory device lies primarily in the fact that in astrophysical systems there are no reflectors or resonators, and no standing waves are set up, so that these are coherent traveling-wave amplifiers. The amplification of the radiation is not the result of multiple passage of the ray through the same bounded volume of gas, but the result of the giant dimensions of the amplifying system. There is no loss connected with resonators and reflectors. Therefore even a small degree of population inversion turns out to be sufficient for effective amplification. A particularly large amplification effect can be observed in nova and supernova flares, when the excitation energy accumulated by the atoms and molecules can be released in the form of a brief but very intense burst of radio emission. This phenomenon could be observed by comparing curves characterizing the time variation of the intensity of the optical and radio emissions during the initial stage of the flare. The foregoing gives grounds for assuming that coherent amplification of radiation is a widespread phenomenon in the Universe. The author thanks Doctor of Physico-mathematical Sciences A. Z. Dolginov for a useful discussion and valuable advice, and the participants of the GAISh Seminar, and especially Doctor of Physico-mathematical Sciences I. S. Shklovskiy for a discussion of the present results and for the idea of using the results to explain the anomaly in the cosmic radio emission of OH. Orig. art. has: 2 formulas. [02]

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